[EA]Current Workflow for Seismic Facies Identification and Characterization in the Miocene Carbonates of the Gulf of Papua and the Eastern Fold Belt of Papua New Guinea*

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Abstract

The characterization of reservoir facies represents one of the greatest challenges when exploring the Oligo-Miocene carbonate play in Papua New Guinea (Figure 1). The heterogeneity in reservoir quality is a key part of the challenge as it incorporates: (1) the initial depositional rock fabric (its primary porosity and permeability), (2) the subsequent impact of early diagenetic effects prior to burial, and (3) later diagenesis during and post burial (can be destructive or accretive to porosity).

Based on seismic mapping integrated with data from the well penetrations in the offshore Gulf of Papua (GOP) and onshore in the Eastern Papuan Basin (EPB), the authors have developed a systematic and structured, seismic-based approach to reservoir facies identification. This workflow is a systematic scorecard methodology that has been modified from Burgess et al (2013).

Using this approach, three seismic facies are recognized: A High Energy Platform and Reef (HEPR) facies, a Low Energy Platform (LEP) facies and a Pelagic-Puri facies:

- The HEPR facies, based on petrographic studies, have better initial porosity as they grew in shallow marine (0-20m water depth) conditions, characterised by high wave energy in the upper euphotic zone. Such bodies are well positioned when sea level drops (low stand event) and subaerial exposure ensues. The introduction and movement of meteoric fluids typically results in extensive secondary porosity development (through carbonate dissolution and dolomitization). These facies have been penetrated in reef margins at Borabi 1, Pandora 1, Uramu 1, Ini 1 and Antelope 1 and are evident on the associated seismic lines.

- The LEP facies in contrast are deposited in an intermediate marine setting (20m-100m water depth) associated with 'oceanic' platform conditions growing in the lower euphotic zone. Such units have been able to benefit from low stand related secondary porosity

enhancement and represent the LEP facies which have been penetrated at the Triceratops platform, Dibiri platform, the lower platform facies at Antelope 1 and Bobcat 1. These facies typically have significantly lower reservoir quality than the HEPR facies but have significantly better porosity than the Pelagic-Puri facies described below.

- The Pelagic-Puri facies are a finer-grained deeper marine (>100m water depth) carbonate that accumulated in basinal areas. They are penetrated at Muabu 1, Ipigo 1, Puri 1, Elk 1 and Raptor 1 and have the poorest reservoir properties of the three facies.

These distinct facies are illustrated in Figure 2.

Using seismic images, a seismic facies atlas of the GOP and EPB drilled carbonates was prepared to provide reference imaging for what typical seismic facies look like at a regional level. Ideally these images were captured over carbonates that have been drilled within the basin to provide the authors with the ability to tie the seismic to actual well data. Several examples of the seismic facies delineation will be discussed in the authors presentation.

With the well data, the authors were able to quantify rock properties of the facies that were penetrated. A correlation between rock properties and seismic character was established, and although there were variations, as outlined in the first paragraph, these were as expected. As an example of one of the properties, it was found that when the porosities for facies were plotted out, they naturally grouped into three distinct distributions (Figure 3). This proved valuable as the authors had a range of distributions that can be used for volumetrics in the prospect maturation process.

The aim of this project was to develop a robust, systematic methodology to support exploration target risking and resource estimation; through application this approach has been shown to be auditable, repeatable and defendable.

References Cited

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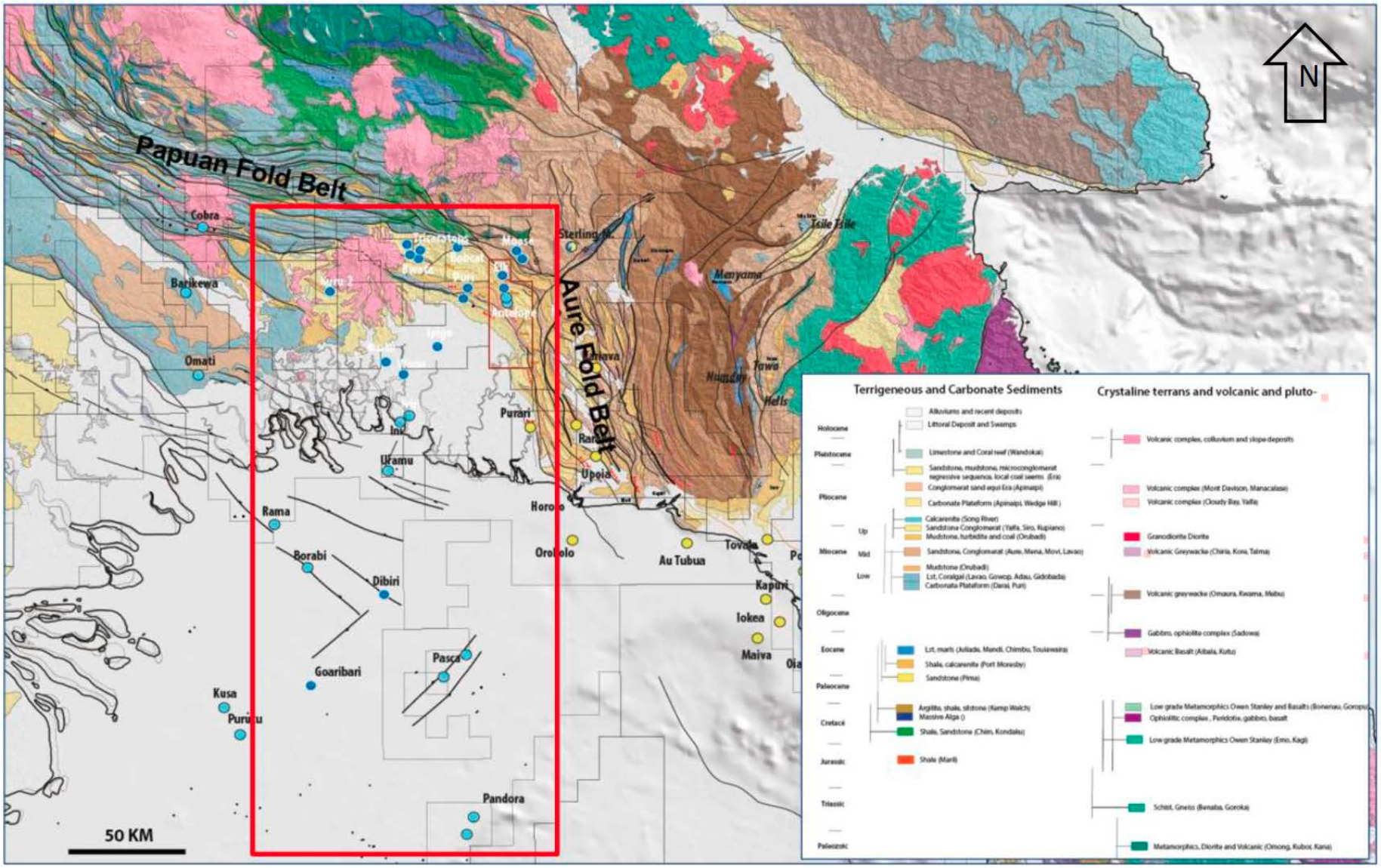

Figure 1. Map with regional geology and structural elements showing area of interest (red outline) for this project. Source Oil Search (PNG) Ltd internal data.

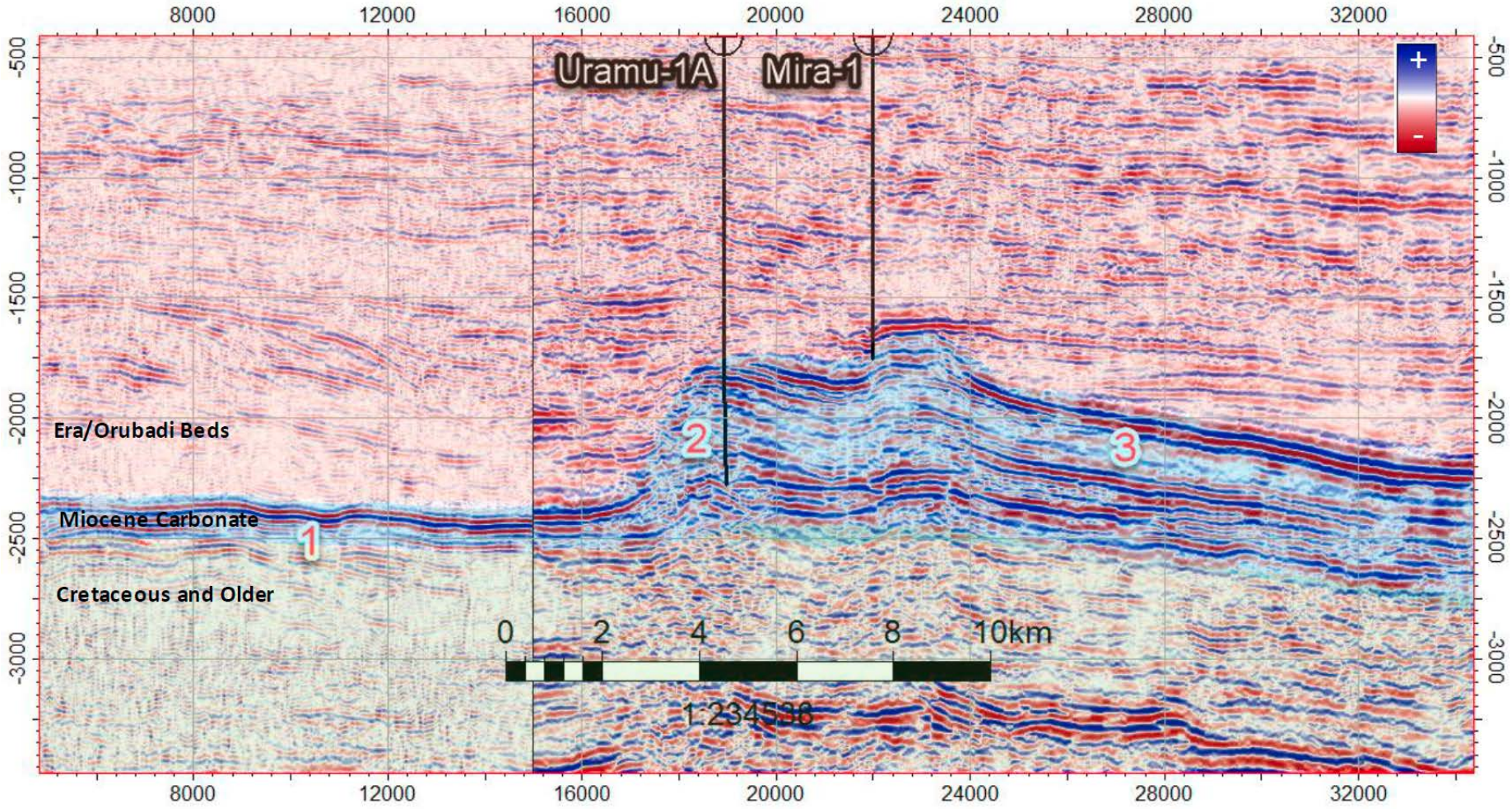

Figure 2. Seismic across the Uramu Platform/Reef outlining the three seismic facies. (1) Pelagic, (2) High Energy Platform/Reef and (3) Low Energy Platform.

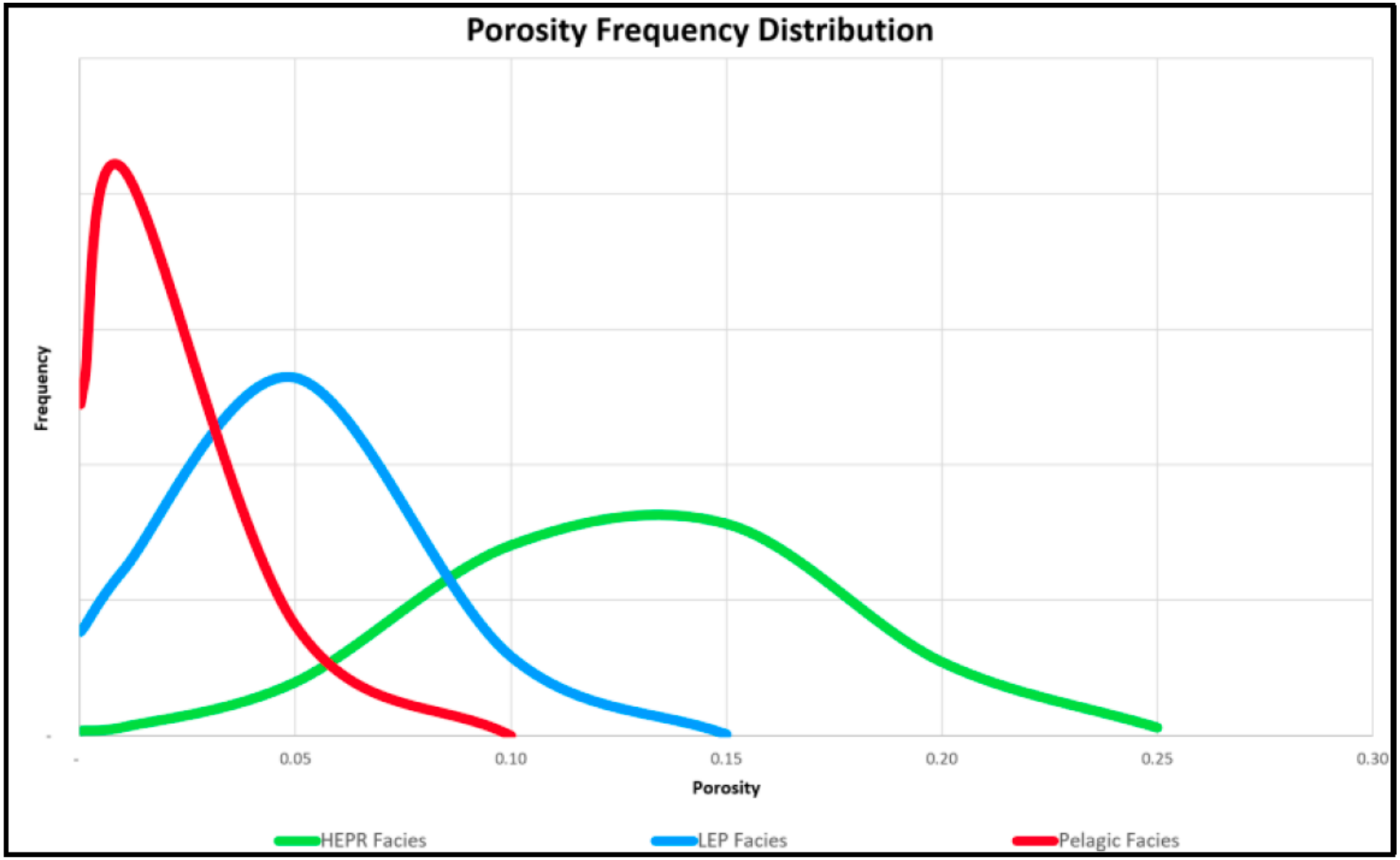

Figure 3. Graph showing the range of porosities in the various wells that penetrated the respective facies. These can be related to the seismic facies.